EXD. R

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NOTES ON THE GENERIC NOMENCLATURE OF THE LEPIDOPTERA RHOPALOCERA, I.

By Francis Hemming, C.M.G., C.B.E., F.R.E.S.

The following notes have been made in the course of recent work on the generic nomenclature of the Lepidoptera Rhopalocera.

(*a*) Genera of which the types are here designated for the first time.

Satyridae.

Mygona Westwood.

Westwood, 1851, *in* Doubleday, Gen. diurn. Lep. (2) : 357.

Type : *Pronophila thelebe* Doubleday, 1849.

Westwood gave what he called " *Mygona* Boisduval MS." as a synonym of *Pronophila* Doubleday, 1849. The type of *Mygona* Westwood (for the name *Mygona* must be credited to Westwood by whom it was published) is necessarily *thelebe* Doubleday, the type of *Pronophila* Doubleday, of which therefore *Mygona* Westwood is a synonym.

Amathusiidae.

Moera Hübner.

Hübner, [1819], Verz. bek. Schmett. (4) : 51.

Type : *Moera phidippe* Hübner, [1819].

The name *Moera* Hübner is invalid, since *phidippe* Hübner is a synonym of *Papilio phidippus* Linnaeus, 1763, the type of *Amathusia* Fabricius, 1807.

Thoraessa Westwood.

Westwood, 1850, *in* Doubleday, Gen. diurn. Lep. (2) : 326.

Type : *Papilio phidippus* Linnaeus, 1763.

Westwood gave what he called " *Thoraessa* Boisduval MS." as a synonym of *Amathusia* Fabricius, 1807. Boisduval had never published the name which must, therefore, be attributed to Westwood himself. The type of *Thoraessa* Westwood is necessarily *phidippus* Linnaeus, the type of *Amathusia* Fabricius, of which therefore *Thoraessa* Westwood is a synonym.

Nymphalidae.

Azania Martin.

Martin, 1903, Deuts. ent. Z. Iris **16** : 160.

Type : *Papilio camillus* Fabricius, 1781.

Though available nomenclatorially, the name *Azania* Martin is not required, since *Papilio camillus* Fabricius is congeneric with *Papilio thyonneus* Cramer, 1779, the type of *Cyrestis* Boisduval, 1832.

Catargyria Hübner.

Hübner, [1823], Samml. exot. Schmett. **2** : pl. [64].

Type : *Catargyria laura* Hübner, [1823], ♂.

Scudder's selection (1875, Proc. amer. Acad. Arts Sci., Boston, **10** : 136) of *Catargyria seraphina* Hübner as the type is invalid, since, as I have shown (Hemming, 1937, Hübner **1** : 407), pl. [62] on which that species was figured was not published by Hübner till 1825. The figures given on pl. [64] (published in 1823) are all referred by Hübner to his *Catargyria laura*. That is, however, a composite species, the so-called male (figs. 1 and 2) representing *Papilio laure* Drury, 1773, while the so-called female is referable to *Catargyria druryi* Hübner, [1825]. One or other of these species must be the type of *Catargyria* Hübner, and I here select the former. Though available nomenclatorially, the name *Catargyria* Hübner is not required, since *Papilio laure* Drury is congeneric with *Papilio agathina* Cramer, 1777, the type of *Doxocopa* Hübner [1819].

Chlorippe Boisduval.

Boisduval, 1870, Consid. Lépid. Guatemala : 47.

Type : *Nymphalis laurentia* Godart, 1824.

The name *Chlorippe* Boisduval is invalid, since it is both a homonym and a synonym of *Chlorippe* Doubleday, 1844, itself a name which falls to *Doxocopa* Hübner, [1819].

Eucalia Felder, C.

Felder, C., 1861, N. Act. Akad. Caes. Leopold. **28** (3) : 25.

Type : *Diadema anthedon* Doubleday, 1845.

The name *Eucalia* Felder is invalid, the type being the same species as that of *Euralia* Westwood, 1850, itself a name which falls to *Hypolimnas* Hübner, [1819].

Eunice Geyer.

Geyer, 1832, *in* Hübner, Zutr. z. Samml. exot. Schmett. **4** : 39, 44.

Type : *Eunice taurione* Geyer, 1832.

The name *Eunice* Geyer is invalid, because it is a homonym of *Eunice* Rafinesque, 1815 (Analyse : 135) and of *Eunice* Schinz, 1822 (*in* Cuvier, Thierreich **2** : 810). It does not require to be replaced, since *Eunice taurione* Geyer is congeneric with *Papilio amelia* Cramer, 1777, the type of *Evonyme* Hübner, [1819].

Heurema Herrich-Schäffer.

Herrich-Schäffer, 1865, CorrespBl. zool.-min. Ver. Regensburg **19** : 89 (*Separate* as Prodromus **1** : 71).

Type : *Papilio lethe* Fabricius, 1793.

The name *Heurema* Herrich-Schäffer is invalid, (*a*) because it is a homonym of *Heurema* Agassiz, 1846 (Nomencl. zool. Index univ. (4to ed.) : 181) and (*b*) because its type is the same species as that of *Hypanartia* Hübner, [1821].

Megistanis Doubleday.

Doubleday, 1844, List Spec. lep. Ins. B.M. **1** : 109.

Type : *Papilio cadmus* Cramer, 1775.

Scudder (1875, Proc. amer. Acad. Arts Sci., Boston, **10** : 213) failed to observe that *Megistanis beotus* Boisduval, which he selected as the type of this

genus, was nothing but a MS. name when published by Doubleday and therefore was ineligible for selection as the type. The type is automatically *Papilio cadmus* Cramer, the only other species given by Doubleday.

Timetes Boisduval.

Boisduval, 1870, Consid. Lépid. Guatemala : 44.

Type : *Papilio marius* Cramer, 1779.

The name *Timetes* Boisduval is invalid, (*a*) because it is a homonym of *Timetes* Doubleday, 1844 (List Spec. lep. Ins. B.M. **1** : 87), and (*b*) because its type is the same species as that of *Euglyphus* Billberg, 1820 (Enum. Ins. : 80), itself a name which falls to *Marpesia* Hübner, 1818.

RIODINIDAE.

Desmozona Boisduval.

Boisduval, 1836, (Roret's Suite à Buffon) Lépid. 1 : explic. pl. 6 [= pl. 2B], pl. 21 [= pl. 5C].

Type : *Desmozona acherois* Boisduval, 1836.

Though available nomenclatorially, the name *Desmozona* Boisduval is not required, since *acherois* Boisduval is congeneric with *caricae* Linnaeus, the type of *Nymphidium* Fabricius, 1807.

Hexuropteris Hübner.

Hübner, [1819], Verz. bek. Schmett. (2) : 22.

Type : *Hexuropteris endymiaena* Hübner, [1819].

The name *Hexuropteris* Hübner is invalid, the type being a synonym of *Papilio gnidus* Fabricius, 1787, the type of *Rusticus* Hübner, [1807], itself a name which falls to *Helicopis* Fabricius, 1807.

PIERIDAE.

Acraea Hübner.

Hübner, [1819], Verz. bek. Schmett. (6) : 93.

Type : *Papilio nerissa* Fabricius, 1775.

The name *Acraea* Hübner is invalid, because it is a homonym of *Acraea* Fabricius, 1807. It does not require to be replaced, since its type is a synonym of *Papilio coronis* Cramer, 1775, the type of *Cepora* Billberg, 1820.

Calicharis Oberthür.

Oberthür, 1876, Études Ent. **1** : 18.

Type : *Anthocharis delphine* Boisduval, 1836.

Though available nomenclatorially, the name *Calicharis* Oberthür is not required, since *Anthocharis delphine* Boisduval, which is a synonym of *Anthocharis antigone* Boisduval, 1836, is congeneric with *Papilio calais* Cramer, 1775, the type of *Colotis* Hübner, [1819].

Colias Hübner.

Hübner, [1819], Verz. bek. Schmett. (7) : 99.

Type : *Papilio sennae* Linnaeus, 1758.

The name *Colias* Hübner is invalid, because it is a homonym of *Colias* Fabricius, 1807. It does not require to be replaced, since *Papilio sennae* Linnaeus is the type also of *Callidryas* Boisduval & Leconte, [1830], itself a name which falls to *Phoebis* Hübner, [1819].

PAPILIONIDAE.

Endopogon Lacordaire.

Lacordaire, 1833, Ann. Soc. ent. France **2** : 384.

Type : *Papilio sesostris* Cramer, 1779.

Though available nomenclatorially, the name *Endopogon* Lacordaire is not required, since *Papilio sesostris* Cramer is congeneric with *Princeps echelus* Hübner, [1815], the type of *Parides* Hübner, [1819].

Laertiades Doubleday.

Doubleday, 1846, Gen. diurn. Lep (1) : 5.

Type : *Papilio philenor* Linnaeus, 1771.

The name *Laertiades* Doubleday is invalid, the type being the same species as that of *Laertias* Hübner, [1819], itself a name which falls to *Battus* Scopoli, 1777.

Parnassis Hübner.

Hübner, [1819], Verz. bek. Schmett. (6) : 90.

Type : *Papilio apollo* Linnaeus, 1758.

The name *Parnassis* Hübner is invalid, the type being the same species as that of *Parnassius* Latreille, 1804.

(*b*) Five genera at present without valid names.

NYMPHALIDAE.

Baeotus gen. n.

Generic characters.—I select as the generic characters of *Baeotus* Hemming the characters given by Seitz for *Megistanis* Westwood when he dealt with this genus in 1914 (Grossschmett. Erde **5** (Exot. 194) : 472).

Type : *Baeotus baeotus* (Doubleday, 1849) (= *Megistanis baeotus* Doubleday, 1849, Gen. diurn. Lep. (2) pl. 48 fig. 2).

The name given above is proposed because *Megistanis* Doubleday, 1844, is not available for *Megistanis baeotus* Doubleday, the type of *Megistanis* Doubleday being *Papilio cadmus* Cramer, 1775.

Zingha gen. n.

Generic characters.—I select as the generic characters of *Zingha* Hemming the characters given by Mabille for *Monura* Mabille, 1877 (Bull. Soc. zool. France **1** : 280).

Type : *Zingha zingha* (Stoll, 1780) (= *Papilio zingha* Stoll, 1780, *in* Cramer, Uitl. Kapellen **4** (27) : 53, pl. 315 fig. B, C.).

The name *Zingha* Hemming is required, since *Monura* Mabille, 1877 (of which *Papilio zingha* Stoll is the type) is a homonym of *Monura* Ehrenberg, 1831 (Sym. Phys. Phyt. : sign. e) and of *Monura* Gistl, 1848 (Nat. Thierr. : 155).

RIODINIDAE.

Calvus gen. n.

Generic characters.—I select as the generic characters of *Calvus* Hemming the characters given by Seitz for the genus *Drepanula* Röber, 1892, when he dealt with that genus in 1917 (Grossschmett. Erde **5** (Exot. 259) : 698).

Type : *Calvus calvus* (Staudinger 1887) (= *Lemonias calvus* Staudinger, 1887, *in* Staudinger and Schatz, Exot. Schmett. **1** (Th. 1) : 259 pl. 92).

The name given above is proposed, because *Drepanula* Röber, 1892, is invalid, being a homonym of *Drepanula* Frölich, 1828 (Enum. Tort. Württ. : 11).

Menander gen. n.

Generic characters.—I select as the generic characters of *Menander* Hemming the characters given by Seitz for *Tharops* Hübner, [1819], when he dealt with the genus in 1917 (Grossschmett. Erde **5** (Exot. 263) : 716).

Type : *Menander menander* (Stoll, 1780) (= *Papilio menander* Stoll, 1780, *in* Cramer, Uitl. Kapellen, **4** (28) : 86 pl. 334 fig. C, D).

The name given above is proposed, because *Tharops* Hübner, [1819], is invalid, being a homonym of *Tharops* Rafinesque, 1815 (Analyse : 119).

HESPERIIDAE.

Aecas gen. n.

Generic characters.—I select as the generic characters of *Aecas* Hemming the characters given by Godman for *Flacilla* Godman, 1901 (*in* Godman & Salvin, Biol. cent.-amer. Lep.-Rhop. **2** : 593).

Type : *Aecas aecas* (Stoll, 1781) (= *Papilio aecas* Stoll, 1781, *in* Cramer, Uitl. Kapellen **4** (29) : 102 pl. 343 fig. A, B).

The name given above is proposed, because *Flacilla* Godman, 1901, is invalid, being a homonym of *Flacilla* Koken, 1896 (Jahrb. geol. ReichsAnst. **46** : 92).

(*c*) Notes on the status of two genera.

NYMPHALIDAE.

Murwareda Moore.

In 1934 (Gen. Names hol. Butt. **1** : 95) I pointed out that *Papilio athamas* Drury, 1773, and its allies could not (as hitherto) be referred either to *Eulepis* Scudder (mistakenly regarded by that author as identical with *Eulepis* Billberg, 1820) or to *Eriboea* Hübner, [1819], and I went on to say that the oldest available generic name for these species was *Murwareda* Moore, 1896 (Lep. ind. **2** (24) : 263) (type, *Charaxes dolon* Westwood, 1847). In making this latter statement, I was in error, since I overlooked the fact that *Papilio pyrrhus* Linnaeus, 1758, the type of *Polyura* Billberg, 1820 (Enum. Ins. : 79) is congeneric with *Papilio athamas* Drury. The position is therefore that, though available nomenclatorially, the name *Murwareda* Moore, 1896, is not required, its type being congeneric with that of *Polyura* Billberg, 1820.

PAPILIONIDAE.

Agehana Matsumura.

Type : *Agehana elwesi maraho* (Shiraki & Sonan, 1934).

Papilio maraho Shiraki & Sonan, 1934, Zephyrus **5** : 177.
Agehana maraho (Shiraki & Sonan) Matsumura, 1936, Ins. matsumur. **10** : 86 pl. 2.

The good coloured plate given by Matsumura shows that *maraho* Shiraki & Sonan, which was discovered in Formosa, is the Formosan subspecies of the insect originally discovered in Kiukiang and named *Papilio elwesi* Leech (1889, Trans. ent. Soc. Lond. **1889** : 113, pl. 7 fig. 1).

This species differs from all other known swallowtails in that the dilation of the tails of the hind-wings is so great that each tail is supported by two veins instead of by one only. It is on this character that *Agehana* Matsumura (1936, Ins. matsumur. **10** : 86) can properly be separated from the remainder of Haase's " Rinnenfalter," which are referable to *Papilio* Linnaeus, 1758 (type, *Papilio machaon* Linnaeus, 1758).

BOOK NOTICE.

A catalogue of the original descriptions of the Rhopalocera found north of the Mexican border. Part 2. The SATYRIDAE. By C. F. DOS PASSOS. pp. S1–S13. (*Bull. Cheyenne Mount. Mus.* **1** (2)). 1939. Price 50 cents.

This second part of the catalogue of original descriptions of butterflies from North America follows closely the pattern of the first part. The following minor changes have, however, been made : Genotypes are now centred under the generic name, Subspecies are lettered in order, and Synonyms are printed in different type.

SOME TYPE SPECIMENS OF *DELIAS* (LEP. PIERIDAE) DESCRIBED BY FRUHSTORFER

By G. TALBOT, F.R.E.S.

THE recent acquisition by the British Museum (Natural History) of the remainder of the Fruhstorfer collection has enabled me to clear up certain difficulties in connection with Fruhstorfer's description of various races of *Delias* which remained obscure at the time of the publication of my monograph of this genus. Two new subspecies are also described, and notes added on certain interesting specimens from the Adams collection. The arrangement is according to that adopted in the monograph.

All the specimens referred to below are in the British Museum (Natural History).

1. *Delias hempeli* Dann., ♀.

♂. *Delias hempeli* Dannatt, 1904, *Entomologist* **37** : 173, pl. VII, fig. 3 (Gilolo).

A female of this species was found in the Fruhstorfer collection mixed with *candida* and labelled "♀ f. *hempeli*."

♀. Upperside black with submarginal creamy spots, closely resembling *D. candida herodias* Voll. which inhabits the same island. Fore-wing strongly dusted with white over the basal area, extending in the cell to beyond vein 2 and filling the base of area 2; costal edge creamy-white, except proximally and near the apex; six submarginal creamy-white spots as in *herodias* but larger; the anterior spot in area 6 is elongate, with a linear prolongation to the margin, and is placed well distad of the spot above it; in *herodias* the two spots have their proximal ends almost in line; the posterior four spots are of somewhat triangular shape with their apices reaching the margin; there is a small indistinct almost double spot below vein 2, close to the margin. Hind-wing with a submarginal row of six creamy-white spots very much as in *herodias*, but with the exception of the anterior oval spot, they are more distinctly triangular with their apices touching the margin; basal area, to end of cell, dusted with white as on fore-wing.

Underside resembles the ♂, and differs from any form of *candida* especially by the absence of any orange-coloured spots on the hind-wing. Fore-wing with greyish-white basal area, extending to the tornus below vein 2, and more strongly marked than in the ♂; some yellow suffusion in the basal half of the cell; costa edged with creamy-white; submarginal spots as on upperside, the two anterior ones tinged with yellow. Hind-wing as in the ♂, the anterior submarginal spot deep yellow, the other spots creamy-white and tinged with yellow, larger than on the upperside, the inner edge of the four posterior ones strongly incurved.

Length of fore-wing : 35 mm., expanse : 72 mm.

Habitat.—Halmaheira, one specimen, from the Fruhstorfer collection. Only a single pair of this species is now known.

2. *Delias sanaca perspicua* Fruhst.

Delias belladonna perspicua Fruhstorfer, 1910, *in* Seitz, *Macrolep. Erde* **9** : 130, t. 56a (♀).
Delias sanaca perspicua Jordan, 1925, *Nov. Zool.* **32** : 282.

Both sexes were described by Fruhstorfer (1910), and the types are in the Fruhstorfer collection. The ♂ belongs to *belladonna* Fabr., and the ♀ to *sanaca* Moore. Jordan (1925), noting the description as insufficient to determine the species, selected as the type the ♀ figured in Seitz.

3. *Delias belladonna yedanula* Fruhst.

Delias belladonna yedanula Fruhstorfer, 1910, *in* Seitz, *Macrolep. Erde* **9** : 130 (Omei Shan).

The types are in the Fruhstorfer collection. The ♂ is *patrua* Leech, and the ♀ is *berinda adelma* Mitis.

4. *Delias crithoe villia* Fruhst.

Delias crithoe villia Fruhstorfer, 1910, *in* Seitz, *Macrolep. Erde* **9** : 134, t. 56a (West Sumatra).

The types of this insect are in the Fruhstorfer collection. The ♂ cannot be distinguished from typical *tobahana* Rog. from Sinabong. The ♀ is purer white on the hind-wing, but yellowish to white examples occur together in the Korintji district. The race *tobahana* is slightly variable, and two forms cannot be distinguished.

5. *Delias discus discus* Honr.

Delias discus Honrath, 1886, *Berlin. ent. Z.* **30** : 130, pl. V, fig. 4 (♀) (Sekar).
Delias discus discus Talbot, 1937, *Monogr. Delias* : 347 (partim).

The nominotypical form came from Sekar on the Onin Peninsula. It is represented in the British Museum by a female from the Adams collection, collected by A. E. Pratt in the district of Fak Fak, 1700 feet, January to February, 1908.

Most specimens of the species in collections are from the Weyland Mountains and central Dutch New Guinea. These belong to the race *captorima* Van Eecke, 1915 (*Nov. Guinea* **13** : 58, pl. II, fig. 4).

The ♀ of the nominotypical form is distinguished from *captorima* by the deeper yellow colour of the hind-wing area, and in this area being similarly coloured throughout, and extending more distad, with a more sharply defined edge.

6. *Delias descombesi* f. *leucacantha* Fruhst.

Delias descombesi leucacantha Fruhstorfer, 1910, *in* Seitz, *Macrolep. Erde* **9** : 131, t. 52b (Sikkim).

The type of this form is a ♀ from Sikkim, with extended yellowish-white colouring on hind-wing, and on the fore-wing with veins 2, 3 and 4 more strongly striped with white; very like a small ♀ from Assam in the British Museum.

7. *Delias belisama* f. *angaja* Fruhst.

Delias belisama f. *angaja* Fruhstorfer, 1910, *in* Seitz, *Macrolep. Erde* **9** : 132 (W. Java).

The brief description of this form in Seitz is misleading. According to the type, a ♀ from Mt. Gede, the upperside is very pale orange, and the fore-wing underside is without the yellow suffusion over the cell which is characteristic of *aurantia*. The hind-wing underside is less orange than in *aurantia*, but deeper yellow than in most *belisama* females, all gradations existing between it and creamy-yellow ones. The name may be applied to the more deeply yellow females from West Java, but these never resemble *aurantia* on the upperside.

8. *Delias belisama nakula* ♂ f. *auratilis* Fruhst.

Delias belisama nakula f. *auratilis* Fruhstorfer, 1910, *in* Seitz, *Macrolep. Erde* **9** : 132, t. 52d.

This form has the upperside of hind-wing yellow or tinged with yellow. The type specimen is only slightly tinged with yellow on the fore-wing, and the five other males in the British Museum are without any yellow tinge on the fore-wing.

9. *Delias aruna arovana* Fruhst.

Delias aruna arovana Fruhstorfer, 1913, *Ent. Runds.* **30** : 124 (Rossel Island).

This race was known from Rossel and Sudest Is. In the Adams collection were 4 ♂♂ 3 ♀♀ from St. Aignan, an island near Rossel.

10. *Delias sacha sacha* Gr.-Sm.

Delias sacha Grose-Smith, 1895, *Nov. Zool.* **2** : 75 (♂, Obi).

The Fruhstorfer collection contained one ♂ of this rare species of which only about 3 ♂♂ are known, the ♀ being still unknown from Obi. The ♂ presents a remarkable resemblance to *D. poecilea edela* Fruhst. which inhabits the same island.

11. *Delias hyparete luzonensis* f. *maenia* Fruhst.

Delias hyparete peirene Fruhstorfer, 1910, *in* Seitz, *Macrolep. Erde* **9** : 125 (Formosa).

The type specimen is a ♂ individual aberration in which the red and yellow scales on the hind-wing are deformed, being curled or twisted, especially the yellow ones over the basal area, giving this area a pink tinge, the submarginal band being dull orange. The name may be used to denote any specimens with orange instead of red spots on the hind-wing underside.

12. **Delias timorensis babberica** subsp. n.

♂. A light form resembling *moaensis* Roths. Upperside of fore-wing with the sub-apical spots shorter and narrower; grey-white area of variable extent as in the allied form Hind-wing with the black border more even, more as in the nominotypical form, and not obviously dentate as in *moaensis*. *Underside* of hind-wing with yellow area as in *moaensis*, the red or orange discal dot absent or indistinct, the red submarginal spots larger than in allied forms.

♀. Upperside with basal areas purer white and not dusted with black as in the nominotypical form and in *moaensis*, and slightly more extended than in the nominotypical form. *Underside* of fore-wing very like *moaensis*; hind-wing as in the ♂.

Habitat.—Babber Island: 6 ♂♂, 4 ♀♀ (types); Kisser Island, 1 ♀; "Timor," 1 ♀; without locality: 2 ♂♂. Most of this material is from the Fruhstorfer collection.

13. **Delias mysis adelphoë** subsp. n.

The name for this race was found in the Fruhstorfer collection, but it appears never to have been published.

♂. Belongs to the group of *lara* forms. Upperside not different from specimens of *onca* Fruhst. from British New Guinea.

Underside of fore-wing with the yellow subapical band formed of four spots instead of three, the additional spot placed in area 7; this spot usually only indicated in mainland specimens; the anterior spot is smaller than in *onca*, and the spot in 6 is narrower. Hind-wing with narrower red band which has very narrow proximal black edging; the red band is placed more proximad, leaving a wide marginal black border which is wider than in the mainland forms; the black area narrows sharply from vein 5 to vein 6.

Habitat.—British New Guinea: Yule Island, 1 ♂ (ex Coll. Fruhstorfer).

14. *Delias mysis rosselliana* Roths.

Delias mysis rosselliana Rothschild, 1915, *Ann. Mag. nat. Hist.* (8) **15** : 174 (♂♀, Rossell I.).

The Adams collection contained 4 ♂♂ of this species from St. Aignan, whence it has not previously been recorded.

Book Notice.

Catalogue raisonné des Coléoptères de France. Par J. Sainte-Claire Deville complété et publié par A. Méquignon. (*L'Abeille* **36** : 1–466.) Paris (Société Entomologique de France). 1935–1938, 4 parts. Price 100 francs.

The four parts making this catalogue were published in April and November 1935, September 1937, and December 1938. They form the complete volume 36 of *L'Abeille*.

The work is, in the main, that of the late Sainte-Claire Deville, who unfortunately died before completion of the manuscript and its subsequent publication. By fortunate good chance his old friend Mons. Méquignon was approached and found willing to prepare and complete the manuscript and pilot it through the press. All workers on the Coleoptera of France will appreciate the spirit of the editor.

The treatment of the material is systematic throughout. Under each genus is arranged the species found in France, and for each species reference to " une bonne description, pas trop ancienne et de préférence rédigée en français " is given wherever possible. Synonymy is normally not noticed. For reasons of cost there is no bibliography.

At his death the author had completed more or less up to the end of the Chrysomelidae, the Rhynchophora and the Scarabaeoidea having not been written up. Few families were so finished as to be ready for the press and the debt owing to Mons. Méquignon by French Coleopterists is large.

Book Notice.

The Fulgorina of Barro Colorado and other parts of Panama. By Z. P. Metcalf. (*Bull. Mus. comp. Zool. Harvard* **82** : 277–423, 23 pls.). 1938.

This is a systematic work on the Fulgorina of the area mentioned in the title. The general classification used is based on that of Muir, supplemented by special work on restricted groups by other authors.

Serious attempt is made to settle the genotypes of many of the genera based on the author's card catalogue of titles of the relevant literature which extends to 750,000 items. The author adds that after 25 years of collecting and collating the literature of the Homoptera he is of the opinion that it is not possible to " collect and catalogue completely the literature dealing with even a small group of insects."

Many keys are given to subfamilies, tribes, genera, and species, and extensive use is made of illustration. Great reliance is placed on the use of genitalia in providing taxonomic characters. There are 139 titles in the bibliography.

THE MORPHOLOGY OF THE THORAX OF THE PELORIDIIDAE (HOMOPT.)

By J. W. Evans, D.Sc., M.A., F.R.E.S.

The Peloridiidae which, according to Helmsing and China (1937), " comprise the rarest and most remarkable of the Hemiptera and which may well be descended in an almost direct line from proto-hemipterous ancestors," are the sole family of the Homopterous series Coleorhyncha.

Up to the present six species have been described. These are *Peloridium hammoniorum* Breddin from South America, *Xenophyes cascus* Bergroth from New Zealand, *Hemiodoecus leai* China and *H. fidelis* Evans from Tasmania, *H. veitchi* Hacker from Queensland and *H. wilsoni* Evans from Victoria.

Until recently the available material of these insects was so limited that morphological studies were well-nigh impossible, but now although *P. hammoniorum* is still only represented by three specimens and *X. cascus* and *H. wilsoni* each by a single specimen, abundant material of the remainder is obtainable.

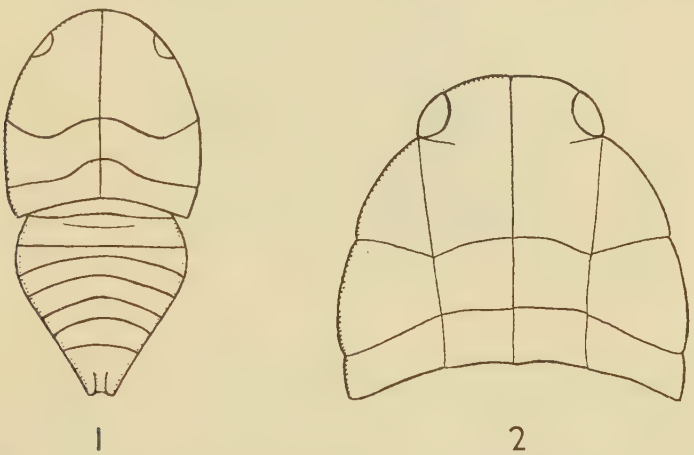

Fig. 1.—*Hemiodoecus fidelis*, first instar nymph, dorsal surface.
Fig. 2.—*Hemiodoecus fidelis*, second instar nymph, thorax, dorsal surface.

In an earlier paper (Evans, 1938) the morphology of the head of *Hemiodoecus fidelis* was described, and it was shown how the primitive structure of the head supplied a key to the understanding of the morphology of the head of insects in families comprised in the Auchenorhyncha. The present paper is concerned with the morphology of the thorax, more particularly the prothorax.

Nymphal Instars.

Helmsing and China found only four nymphal instars in *Hemiodoecus veitchi*, but were uncertain whether this was because they lacked material of a possible fifth instar. It is certain that there are only four if the pronymphal instar is excluded.

First Instar.

The first instar nymph of *H. fidelis* is shown in dorsal aspect in fig. 1. It will be noted that the head and pronotum are fused together and that the mesonotum is only slightly larger than the metanotum. Helmsing and China show a pair of pits on each thoracic segment, lying immediately behind the eyes, in their figure of the first instar nymph of *H. veitchi*. Similar pits have not been found in *H. fidelis*, but the invaginations of the pleural sutures are visible through the dorsal integument in identical positions.

Second Instar.

Fig. 2 represents the dorsal surface of the head and thorax of the second instar nymph of *H. fidelis*. Although the head is still partially fused with the pronotum, it does not form part of one curved surface with it. The principal point of interest is that a pair of sutures has been developed that extends posteriorly from the hind margin of the external border of the eyes on each side as far as the hind margin of the metanotum. These sutures cut off the wing-pads from the central portion of the thorax.

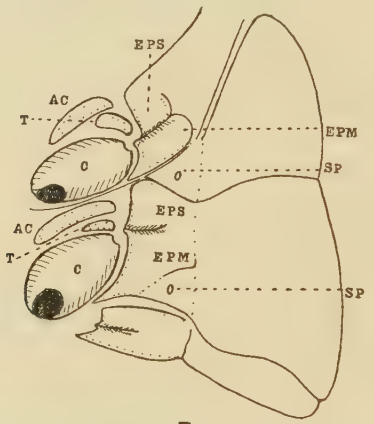

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Fig. 3.—*Hemiodoecus fidelis*, third instar nymph, thorax, ventral surface. eps., episternum; epm., epimeron; ac., ante-coxale; t., trochantin; sp., spiracle; c., coxa.

Third Instar.

In the third instar in addition to dorsal longitudinal sutures being present, ventral ones are also developed. These lie immediately below the dorsal sutures. Fig. 3 represents the ventral surface of the thorax of a third instar nymph of *H. fidelis*, the coxae and accompanying sclerites of the metathorax are not shown. Lying anteriorly to the coxa of the front leg are two small sclerites. These are the trochantin and the ante-coxale. The pleural suture separating the episternum from the epimeron is distinct and the longitudinal suture previously mentioned is well defined as far as the posterior corner of the epimeron. This suture divides the remainder of the prothorax figured into three parts : one of these extends from the base of the episternum and epimeron as far as the eyes, another lies immediately behind the epimeron and bears a spiracle, whilst the third, which is the largest, extends from the suture up to the

lateral margin of the thorax. A comparison of the prothorax with the mesothorax shows that an ante-coxale and trochantin are present on both, that both have a small triangular area of tergal origin bearing a spiracle, but in the prothorax, the episternum and epimeron do not meet the tergal wing-pad as they do in the mesothorax.

The metathorax is considerably reduced but resembles the mesothorax in essential structure.

Myers and China (1929) have described the morphology of the thorax of an adult specimen of *Hemiodoecus leai*. The episternum, they misinterpreted as the epimeron and the ante-coxale as the kat-episternum. Later Helmsing and China stated that Mrs. M. D. Haviland Brindley had (*in litt.*) criticised the homologies given by Myers and China. My interpretation is in agreement with that of Mrs. Brindley.

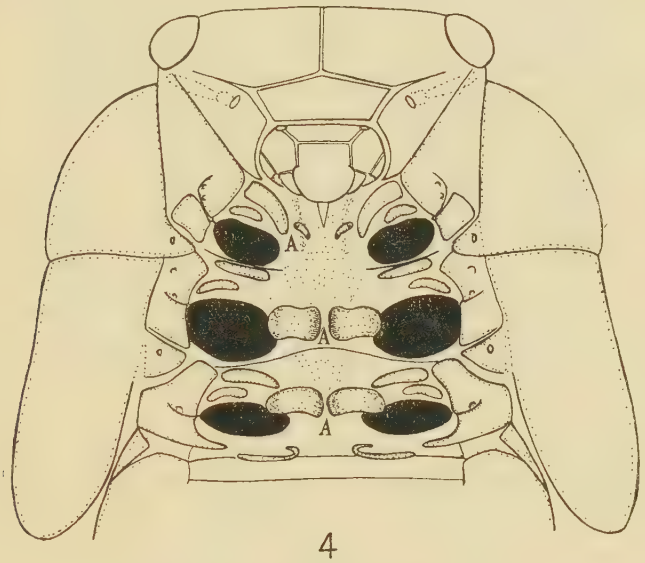

Fig. 4.—*Hemiodoecus fidelis*, fourth instar nymph, ventral surface viewed dorsally. A., entosternal arms.

Fourth Instar.

The fourth or pre-imaginal instar differs from the third in the lengthening of the wing-pads of the mesothorax and in the almost total disappearance of metathoracic wing-pads.

Fig. 4 represents the head and thorax of a nymph of *H. fidelis* in the pre-imaginal instar, the ventral surface being viewed from above. Lying slightly on each side of the middle line in each segment is a pair of projecting arms that arise from the eusternum. These are entosternal arms which in most pterygote insects arise from a common median base and are not separated as shown in the figure. The processes belonging to the prosternum are smaller than those in the other segments and were believed by Myers and China to be an episterna and by Mrs. Brindley to represent the anterior laterale. In the prothorax the basisternum and eusternum are combined, whilst in the meso- and metathorax only the basisternum is distinct. It is possible that the pair of long narrow sclerites lying against the posterior margin of the metathorax represent the post-coxal bridges, no sign of which remains in the two anterior segments.

Adult.

The thorax and part of the tegmina of an adult *H. fidelis* are shown in fig. 5. The longitudinal sutures are no longer apparent, their position being occupied by the line of junction of the paranota with the body of the prothorax. The spiracles of the prothorax now occupy an intersegmental position posterior to the epimera.

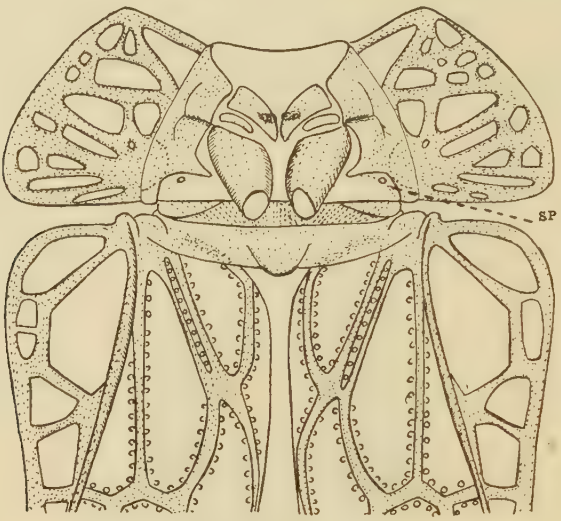

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Fig. 5.—*Hemiodoecus fidelis*, prothorax of adult in ventral aspect.

Wing Development and Venation.

Prothorax.

The type of *H. fidelis* and all those specimens that were collected at the same time as the type had paranotal expansions on the prothorax with numerous small areolets (fig. 7, a). Later collections made in other localities yielded individuals no two of which were exactly similar so far as paranotal development was concerned, but the majority appeared to have distinct veins, the venation being reminiscent of that which occurs in nymphal wing-pads of other Homoptera. Examination of fourth instar nymphs killed in formol and mounted in glycerine jelly disclosed the fact that tracheae entered the pronotal wing-flaps, but whilst the tracheae of the mesothoracic wing-pads were found to be constant in number and position, those of the prothorax were variable (fig. 6).

In fig. 7 are shown six examples (a–f) of paranota of *H. fidelis*, the most frequently found type being shown in fig. 7, f. It is suggested that the veins represent a radial or costo-radial group, a distinct media and a cubito-anal group. Fig. 7, g and h, represent the paranota of *Xenophyes cascus* and *Hemiodoecus leai* respectively for comparison with those of *H. fidelis*.

Mesothorax.

The tegmina among the PELORIDIIDAE are of two types, both macropterous and sub-brachypterous individuals occurring. The macropterous type, with which the tegmina are fully developed and overlap apically, is known only from the single male specimen of *Peloridium hammoniorum* from Puerto Toro, Navarin Island, Tierra del Fuego; the other known specimens of *P. hammoniorum* and the species in the other two genera being all sub-brachypterous. The tegmen of the macropterous form of *P. hammoniorum* is shown in fig. 8, a, that of the sub-brachypterous form in 8, b, whilst figs. 8, c and 8, d represent the tegmina of *H. fidelis* and *H. leai* respectively. Without reference to fig. 8, a or to the pre-venational tracheation, it would be impossible to interpret the venation of the tegmina of the sub-brachypterous forms, as has been done in the figures.

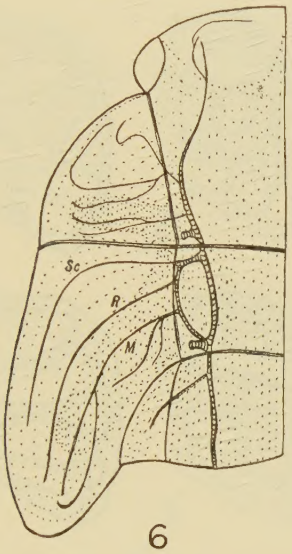

FIG. 6.—*Hemiodoecus fidelis*, fourth instar nymph, showing tracheation of the pronotal paranotum and the mesothoracic wing-pad.

DISCUSSION.

It is generally accepted that wings arose in the first instance as lateral expansions of the thoracic terga, and it has been suggested by Snodgrass (1935) that the first step in the evolution of paranotal lobes into organs of flight must have consisted in the acquisition of a line of flexibility at the base of each lobe.

Assuming that the longitudinal thoracic sutures already described represent such a line of flexibility, then the pronotal paranota of the PELORIDIIDAE are not secondary developments, such as occur in many other living insects, especially Tingid bugs (e.g. *Stephanitis queenslandensis* Hacker), but represent true wing-flaps such as those possessed by a number of Palaeozoic insects.

Five families of the Palaeodictyoptera had representatives with prothoracic "wings," of which the best known, since it is most frequently figured, is the Carboniferous *Stenodictya lobata* Brongniart. An even better example is the Permian insect, *Lematophora typica* Sellards, of which Tillyard (1928) wrote as follows :—

" The most remarkable part of the prothorax are the two pronotal expansions, homologous with wings. Each expansion is covered all over with an immense number of tiny hairs or microtrichia exactly similar to those found on the wings, and at first sight appears also to possess a series of slender branching veins like those of the wings. Careful examination, however, shows that these apparent veins are not chitinised like true veins, but are the courses of pigment bands carrying slightly larger hairs homologous with the macrotrichia found on many of the true veins of the wings. They are thus in exactly the same condition as the wing sheaths of the last larval instar in many Hemimetabola. There are eight or nine of these radiating pigment bands, of which the larger ones may be branched; some irregular connections also exist between them resembling cross-veins. It is almost certain that tracheae must have underlain these bands."

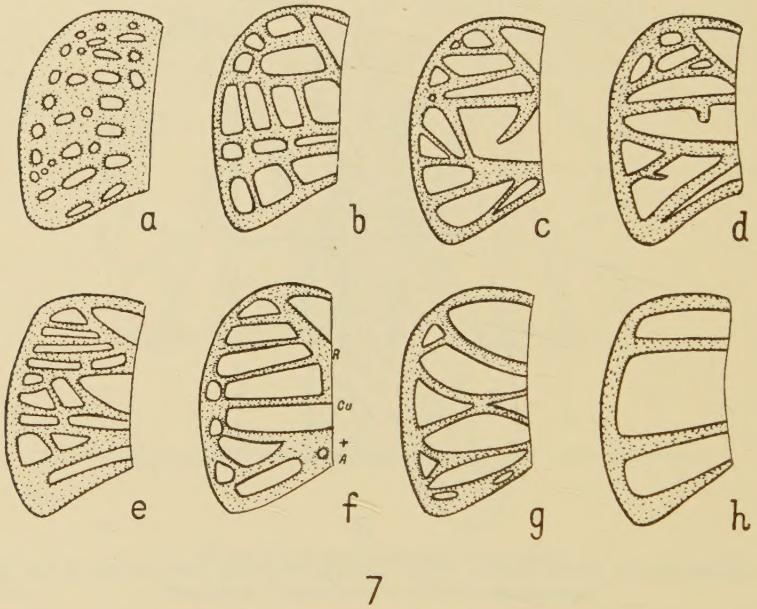

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Fig. 7.—a–f, pronotal paranota of *H. fidelis* ; g, *X. cascus* ; h, *H. leai*.

Wing-like prothoracic lobes occurring on the nymphs of certain Ephemeroptera have been described by Ide (1936). These lobes, which that author considered to be homologous with wing-pads, do not persist in the adult insects.

It is thought that the paired longitudinal thoracic sutures, the alar sutures, are unique amongst living insects. Helmsing and China were uncertain as to their identity, but believed them to be confined to the ventral surface of the prothorax and failed to note their occurrence on the dorsal surface and their continuation on to the meso- and metathorax.

It is a disputed question whether the wing-pads are of tergal or pleural origin, but the balance of opinion supports the view that they are tergal structures. On the basis of this assumption it would appear that the thoracic spiracles of the nymphs of *Hemiodoecus* are on ventral extensions of the terga of the pro- and mesothorax. Whilst in many insects the spiracles assume an intersegmental

appearance, particularly in the thorax, being situated just in front of the segments to which they properly belong; they may come to lie on the terga, near the margin of the latter. Thus the spiracles often regarded as belonging to the prothorax pertain in all probability to the mesothorax, having undergone a secondary forward migration. Snodgrass (1927) states that there is much reason, from developmental studies, for regarding the usual first pair of thoracic spiracles as belonging to the mesothorax and the second to the metathorax. He adds, however, that it is disconcerting to observe that the dorsal muscle from the closing lever of the first spiracle of a caterpillar is attached dorsally to the lateral margin of the protergal shield, and still more so to find that there is a spiracle on the prothorax of *Japyx* and related genera in addition to one on the mesothorax.

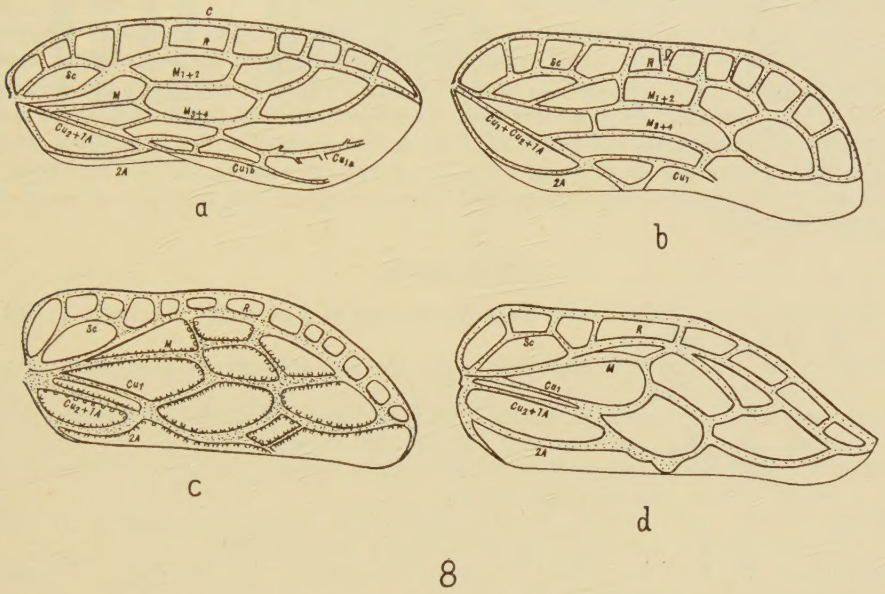

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FIG. 8.—a. tegmen of macropterous form of *P. hammoniorum*; b. tegmen of sub-brachypterous form of *P. hammoniorum*; c. tegmen of *H. fidelis*; d. tegmen of *H. leai*.

Two alternatives are possible to explain the position of the thoracic spiracles in *Hemiodoecus*. Either that its immediate ancestor had three pairs of thoracic spiracles and that the pair belonging to the metathorax was lost following the degeneration of the hind-wings, or that it had the usual two pairs in the meso- and metathorax and that, as a result of the cessation of development of hind-wings and the retention of the tracheation of the pronotal paranota, both pairs of spiracles shifted forwards. The latter explanation is the more probable because the spiracles lie at the hind border of the pro- and mesothorax, and in other Homoptera they lie close to the anterior margin of the meso- and metathorax. Also in *Lepisma saccharina* L., Sulc (1927) has shown that although tracheae enter the lateral thoracic tergal outgrowths of each of the three segments of the thorax, the two pairs of spiracles are situated close to the anterior margin of the meso- and metathorax.

Apart from *Hemiodoecus fidelis* and *Xenophyes cascus* the venation of the paranota of the PELORIDIIDAE conforms to one type, three cells and two veins being developed. The variation apparent in *H. fidelis* may be because the veins of the paranota have but little supporting and strengthening function. The courses of the principal wing-veins are determined to a certain extent by the tracheae, and their position is in part determined by their function as wing-braces. Hence, where there is no function of support it is not surprising to find that as the tracheae are not constant in position, neither are the veins.

The venation of the tegmen is of an unusual type and bears no very close relationship to that of any known living or fossil insect. Certain of the Fulgoroidea have a development of Cu, as shown for the macropterous form of *P. hammoniorum*, but the presence and position of the sub-costal vein is more reminiscent of the wings of Permian psocids figured by Carpenter (1932) than of those of any known Homoptera.

Quite apart from the retention of pronotal paranota, the thorax of *Hemiodoecus* displays several other primitive characters, both in the sternal and pleural region. The entosternal arms (fig. 4, A) have already been mentioned as of interest, as they do not arise from a common median base. Likewise the presence of the separate components of the anterior coxal bridge is unusual, and although a trochantin is retained by many groups of insects, in the Homoptera it is only with certain Fulgoroidea that the ante-coxale has been observed as a distinct sclerite.

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